WHAT IS CLAIMED IS:

1. A method for matching a two dimensional image to one of a plurality of three dimensional candidate models, the method comprising the steps of:

determining the position and orientation of the two dimensional image;

for each three dimensional candidate model, computing a histogram-like table having a computed brightness coefficient for each surface normal of the three dimensional candidate model based on the corresponding value in the two dimensional image, each brightness coefficient depending only on the corresponding surface normal;

successively rendering each three dimensional candidate model in the determined position and orientation using the surface normals in conjunction with the corresponding computed brightness histogram-like table; and

comparing the two dimensional image with each of the rendered three dimensional candidate models.

2. The method of claim 1, further comprising the steps of determining if the two dimensional image matches one of the plurality of three dimensional models if the comparison between the two dimensional image and the rendered three dimensional model is within a predetermined allowable error.

3. The method of claim 1, wherein the comparison step results in a ranking for each of the rendered three dimensional models which indicates the likelihood that the corresponding three dimensional model matches the two dimensional image.

4. The method of claim 3, further comprising the step of choosing the three dimensional model corresponding to the rendered three dimensional model having the highest ranking as the three dimensional model which matches the two dimensional image.

5. The method of claim 1, further comprising the step of reading the three dimensional models from a database containing the plurality of three dimensional models.

6. The method of claim 1, wherein the comparing step is done simultaneously with the rendering step for each rendered three dimensional model.

7. The method of claim 1, wherein the computing step sets a minimum threshold of reflectance to be used in the computation of the histogram-like table.

8. The method of claim 1, wherein the computing step sets a minimum and/or maximum threshold of intensity to be used in the computation of the histogram-like table.

9. The method of claim 1, wherein the two dimensional image is a color image and wherein the a brightness coefficient is computed for each color component of the color image.

10. The method of claim 1, further comprising the step of smoothing the lightsphere histogram-like table to improve the rendering of each three dimensional model and the performance of the method.

11. The method of claim 10, wherein the smoothing step is done by a convolution with a small box function or other small

smoothing kernel.

12. A method for matching a two dimensional image to one of a plurality of three dimensional candidate models, the method comprising the steps of:

determining the position and orientation of the two dimensional image;

for each three dimensional candidate model, computing a histogram-like table having a computed brightness coefficient for each surface normal of the three dimensional candidate model based on the corresponding value in the two dimensional image, each brightness coefficient depending only on the corresponding surface normal;

computing the variance of the brightness coefficients that are used to create each bucket of the histogram-like table, a bucket being a set of similar normal values that are lumped together to form a single argument value in the histogram-like table;

computing the sum of the variances of the histogram-like table buckets; and

ranking the three dimensional candidate models using its computed sum as an error function, the ranking indicating the likelihood that the corresponding three dimensional model matches the two dimensional image.

13. The method of claim 12, further comprising the step of choosing the three dimensional model corresponding to the three dimensional model having the highest ranking as the three dimensional model which matches the two dimensional image.

14. The method of claim 12, further comprising the step of reading the three dimensional models from a database containing the plurality of three dimensional models.

15. The method of claim 12, wherein the computing step sets a minimum threshold of reflectance to be used in the computation of the histogram-like table.

16. The method of claim 12, wherein the computing step sets a minimum and/or maximum threshold of intensity to be used in the computation of the histogram-like table.

17. The method of claim 12, wherein the two dimensional image is a color image and wherein the a brightness coefficient is computed for each color component of the color image.

18. The method of claim 12, wherein the sum of the variances are weighted by the number of samples in each bucket.

19. A method for matching a two dimensional image to one of a plurality of three dimensional candidate models, the method comprising the steps of:

determining the position and orientation of an object giving rise to the two dimensional image;

computing a representation of lighting effects that allows the lighting that gave rise to the two dimensional image to be used to render a realistic image of a three dimensional candidate model;

successively rendering each three dimensional candidate model in the determined position and orientation using the

surface normals in conjunction with the corresponding computed representation of lighting effects; and

comparing the two dimensional image with each of the rendered three dimensional candidate models.

20. A method for matching a two dimensional image to one of a plurality of three dimensional candidate models, the method comprising the steps of:

determining the position and orientation of an object giving rise to the two dimensional image;

computing a representation of lighting effects based on the plurality of three dimensional candidate models and the two dimensional image that allows evaluation of the likelihood that a particular three dimensional candidate model gave rise to a particular two dimensional image; and

choosing the most likely three dimensional candidate model to have generated the query based on the computed representation of lighting effects.

21. A computer program product embodied in a computer-readable medium for matching a two dimensional image to one of a plurality of three dimensional candidate models stored in a database, the computer program product comprising:

computer readable program code means for determining the position and orientation of the two dimensional image;

computer readable program code means for computing a histogram-like table each three dimensional candidate model, having a computed brightness coefficient for each surface normal

of the three dimensional candidate model based on the corresponding value in the two dimensional image, each brightness coefficient depending only on the corresponding surface normal;

computer readable program code means for successively rendering each three dimensional candidate model in the determined position and orientation using the surface normals in conjunction with the corresponding computed brightness histogram-like table; and

computer readable program code means for comparing the two dimensional image with each of the rendered three dimensional candidate models.

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22. A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform method steps for matching a two dimensional image to one of a plurality of three dimensional candidate models, the method comprising the steps of:

determining the position and orientation of the two dimensional image;

for each three dimensional candidate model, computing a histogram-like table having a computed brightness coefficient for each surface normal of the three dimensional candidate model based on the corresponding value in the two dimensional image, each brightness coefficient depending only on the corresponding surface normal;

successively rendering each three dimensional candidate model in the determined position and orientation using the surface normals in conjunction with the corresponding computed brightness histogram-like table; and

comparing the two dimensional image with each of the rendered three dimensional candidate models.

23. A computer program product embodied in a computer-readable medium for matching a two dimensional image to one of a plurality of three dimensional candidate models stored in a database, the computer program product comprising:

computer readable program code means for determining the position and orientation of the two dimensional image;

computer readable program code means for computing a histogram-like table for each three dimensional candidate model, having a computed brightness coefficient for each surface normal of the three dimensional candidate model based on the corresponding value in the two dimensional image, each brightness coefficient depending only on the corresponding surface normal;

computer readable program code means for computing the variance of the brightness coefficients that are used to create each bucket of the histogram-like table, a bucket being a set of similar normal values that are lumped together to form a single argument value in the histogram-like table;

computer readable program code means for computing the sum of the variances of the histogram-like table buckets; and

computer readable program code means for ranking the three dimensional candidate models using its computed sum as an error function, the ranking indicating the likelihood that the corresponding three dimensional model matches the two dimensional image.

24. A program storage device readable by machine, tangibly

embodying a program of instructions executable by the machine to perform method steps for matching a two dimensional image to one of a plurality of three dimensional candidate models, the method comprising the steps of:

determining the position and orientation of the two dimensional image;

for each three dimensional candidate model, computing a histogram-like table having a computed brightness coefficient for each surface normal of the three dimensional candidate model based on the corresponding value in the two dimensional image, each brightness coefficient depending only on the corresponding surface normal;

computing the variance of the brightness coefficients that are used to create each bucket of the histogram-like table, a bucket being a set of similar normal values that are lumped together to form a single argument value in the histogram-like table;

computing the sum of the variances of the histogram-like table buckets; and

ranking the three dimensional models using its computed sum as an error function, the ranking indicating the likelihood that the corresponding three dimensional candidate model matches the two dimensional image.

25. A computer program product embodied in a computer-readable medium for matching a two dimensional image to one of a plurality of three dimensional candidate models stored in a database, the computer program product comprising:

computer readable program code means for determining the position and orientation of an object giving rise to the two dimensional image;

computer readable program code means for computing a representation of lighting effects that allows the lighting that gave rise to the two dimensional image to be used to render a realistic image of a three dimensional candidate model;

computer readable program code means for successively rendering each three dimensional candidate model in the determined position and orientation using the surface normals in conjunction with the corresponding computed representation of lighting effects; and

computer readable program code means for comparing the two dimensional image with each of the rendered three dimensional candidate models.

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26. A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform method steps for matching a two dimensional image to one of a plurality of three dimensional candidate models, the method comprising the steps of:

determining the position and orientation of an object giving rise to the two dimensional image;

computing a representation of lighting effects that allows the lighting that gave rise to the two dimensional image to be used to render a realistic image of a three dimensional candidate model;

successively rendering each three dimensional candidate

model in the determined position and orientation using the surface normals in conjunction with the corresponding computed representation of lighting effects; and

comparing the two dimensional image with each of the rendered three dimensional candidate models.

27. A computer program product embodied in a computer-readable medium for matching a two dimensional image to one of a plurality of three dimensional candidate models stored in a database, the computer program product comprising:

computer readable program code means for determining the position and orientation of an object giving rise to the two dimensional image;

computer readable program code means for computing a representation of lighting effects based on the plurality of three dimensional candidate models and the two dimensional image that allows evaluation of the likelihood that a particular three dimensional candidate model gave rise to a particular two dimensional image; and

computer readable program code means for choosing the most likely three dimensional candidate model to have generated the query based on the computed representation of lighting effects.

28. A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform method steps for matching a two dimensional image to one of a plurality of three dimensional candidate models, the method comprising the steps of:

determining the position and orientation of an object giving rise to the two dimensional image;

computer readable program code means for computing a representation of lighting effects based on the plurality of three dimensional candidate models and the two dimensional image that allows evaluation of the likelihood that a particular three dimensional candidate model gave rise to a particular two dimensional image; and

computer readable program code means for choosing the most likely three dimensional candidate model to have generated the query based on the computed representation of lighting effects.